1.0 Introduction

In 1990, when Congress amended the Clean Air Act Amendments (CAAA), Title IV (Acid Deposition Control Program) mandated a significant reduction in sulfur dioxide (SO_2) emissions (approximately 10 million tons) to occur in two phases. The first phase was implemented in 1995 when large electric generating facilities reduced emissions. The second phase began in 2000 and targets other power plants. Titles IV and IX of the CAAA require that the environmental effectiveness of the Acid Deposition Control Program be assessed through environmental monitoring. This monitoring is required to gauge the impact of emission reductions on air pollution, atmospheric deposition, and the health of affected human populations and ecosystems. The Clean Air Status and Trends Network (CASTNet) was established by the U.S. Environmental Protection Agency (EPA) in 1991 to provide an effective monitoring and assessment network necessary for determining the status and trends in air quality and pollutant deposition as well as relationships among emissions, air quality, deposition, and ecological effects. The Mountain Acid Deposition Program (MADPro) was initiated in 1993 as part of the research necessary to support CASTNet's objectives. MACTEC Engineering and Consulting, Inc. (MACTEC) operates both CASTNet and MADPro on behalf of EPA and other agencies.

MADPro's two main objectives are to develop cloud water measurement systems to be used in a network-monitoring environment and to update the cloud water concentration and deposition data collected in the Appalachian Mountains during the National Acid Precipitation Assessment Program (NAPAP) in the 1980s. MADPro measurements were conducted from 1994 through 1999 during the warm season (May through October) at three permanent mountaintop sampling stations. These sampling stations were located at Whiteface Mountain, NY; Clingmans Dome, TN; and Whitetop Mountain, VA. A mobile manual sampling station also operated at two locations in the Catskill Mountains in New York during 1995, 1997, and 1998. Measurements during the 2000 and 2001 sampling seasons were collected from two sites: Whiteface Mountain, NY and Clingmans Dome, TN. During the 2002 and 2003 sampling seasons, measurements were only collected from the one site at Clingmans Dome, TN (CLD303). Currently, CLD303 is being operated under direction of EPA and the National Park Service (NPS). This report is specifically for the activities and results from the CLD303 site during the 2003 field sampling season.

This report consists of five additional sections and three appendices. Section 2.0, Site Description and Methods, presents an overview of field, laboratory, and data operations and the quality assurance (QA) program. Section 3.0, Liquid Water Content and Cloud Water Chemistry, presents analyses of cloud frequency, liquid water content (LWC), cloud chemistry, and summary statistics for the 2003 data with comparisons to the 1995 through 2002 data set. Cloud

deposition estimates are presented in Section 4.0. The deposition estimates were calculated by applying the cloud water deposition computer model (CLOUD) (Lovett, 1984), parameterized with site-specific cloud water chemistry and meteorological data. Section 5.0 presents filter pack concentrations, modeled dry deposition fluxes, and estimates of total (cloud and dry) deposition. Finally, Section 6.0 discusses the conclusions and recommendations for MADPro.